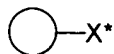



AMENDMENTS TO THE CLAIMS

1-13. (Canceled)

14. (New) A process for the production of chiral ligands comprising:
providing a starting material of Formula (A):



(A)

wherein X* is a chiral or achiral directing group; and wherein  is selected from the group consisting of an unsubstituted mono-aryl group, an unsubstituted polycyclic aryl group, an unsubstituted cycloalkyl group, a substituted mono-aryl group, a substituted polycyclic aryl group, and a substituted cycloalkyl group;

ortho-lithiating the substrate;

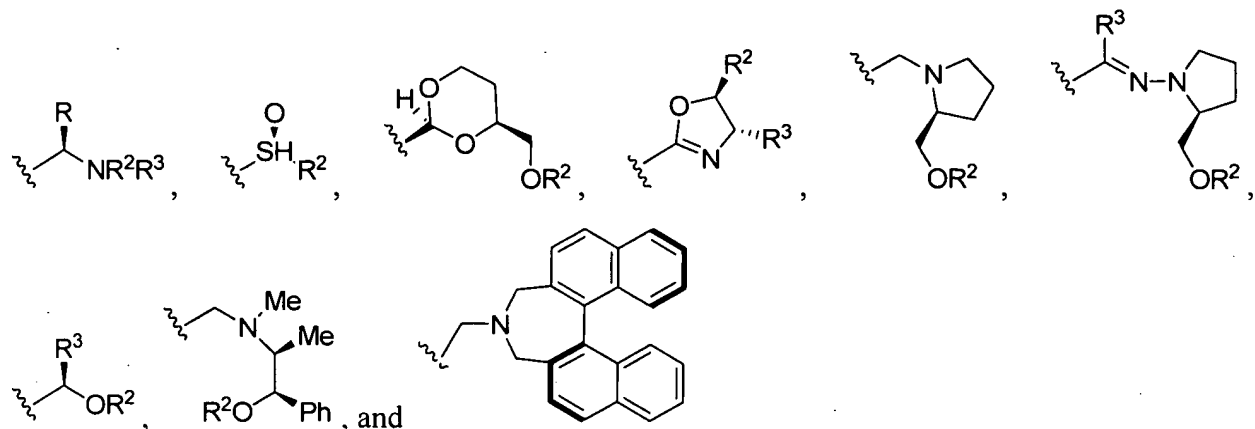
converting the ortho-lithiated substrate to include a phosphine group having the formula $-PR^1R^{1'}$, wherein R^1 and $R^{1'}$ are different from each other and are independently selected from the group consisting of substituted branched-chain alkyl, substituted straight-chain alkyl, substituted alkoxy, substituted alkylamino, substituted cycloalkyl, substituted cycloalkoxy, substituted cycloalkylamino, substituted carbocyclic aryl, substituted carbocyclic aryloxy, substituted heteroaryl, substituted heteroaryloxy, substituted carbocyclic arylamino, and substituted heteroarylamino, unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted alkoxy, unsubstituted alkylamino, unsubstituted cycloalkyl, unsubstituted cycloalkoxy, unsubstituted cycloalkylamino, unsubstituted carbocyclic aryl, unsubstituted carbocyclic aryloxy, unsubstituted heteroaryl, unsubstituted heteroaryloxy, unsubstituted carbocyclic arylamino, and unsubstituted heteroarylamino; and

converting X* to a different grouping to produce a chiral ligand.

15. (New) The process according to Claim 14, wherein X* is a chiral directing group and the step of ortho-lithiating is enantioselective.

16. (New) A process according to Claim 15, wherein X* is selected from the group consisting of


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wherein R, R², and R³ are independently selected from the group consisting of unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted cycloalkyl, unsubstituted carbocyclic aryl, unsubstituted heteroaryl, substituted branched-chain alkyl, substituted straight-chain alkyl, substituted cycloalkyl, substituted carbocyclic aryl, and substituted heteroaryl.

17. (New) The process according to Claim 14, wherein X* is an achiral directing group and wherein ortho-lithiating is conducted in the presence of a chiral auxiliary and is enantioselective.

18. (New) The process according to Claim 17, wherein X* is selected from the group consisting of $\text{---NR}^2\text{R}^3$, $\text{---SO}_2\text{R}^2$, $\text{---C(=O)NR}^2\text{R}^3$, and $\text{---P(O)R}^2\text{R}^3$, and wherein R² and R³ are independently selected from the group consisting of unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted cycloalkyl, unsubstituted carbocyclic aryl, unsubstituted heteroaryl, substituted branched-chain alkyl, substituted straight-chain alkyl, substituted cycloalkyl, substituted carbocyclic aryl, and substituted heteroaryl.

19. (New) The process according to Claim 14, wherein  is a substituted or unsubstituted aromatic ring of a metallocene compound.

20. (New) The process according to Claim 14, wherein X* is an ortho directing group.

21. (New) The process according to Claim 14, further comprising the step of reacting the ortho-lithiated substrate with an R¹ substituted phosphine or an R¹ substituted arsine to form an intermediate compound.

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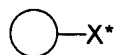
22. (New) The process according to Claim 21, comprising reacting the intermediate compound with an R^{1''}-bearing Grignard reagent or organolithium compound.

23. (New) A chiral ligand produced by the process according to Claim 14.


24. (New) A transition metal complex catalyst comprising at least one chiral ligand produced according to the process of Claim 14.

25. (New) An asymmetric catalyst comprising the transition metal complex catalyst of Claim 24.

26. (New) A process for the production of chiral ligands comprising:
providing a starting material of Formula (A):



(A)

wherein X* is a chiral or achiral directing group; and wherein  is selected from the group consisting of an unsubstituted mono-aryl group, an unsubstituted polycyclic aryl group, an unsubstituted cycloalkyl group, a substituted mono-aryl group, a substituted polycyclic aryl group, and a substituted cycloalkyl group;

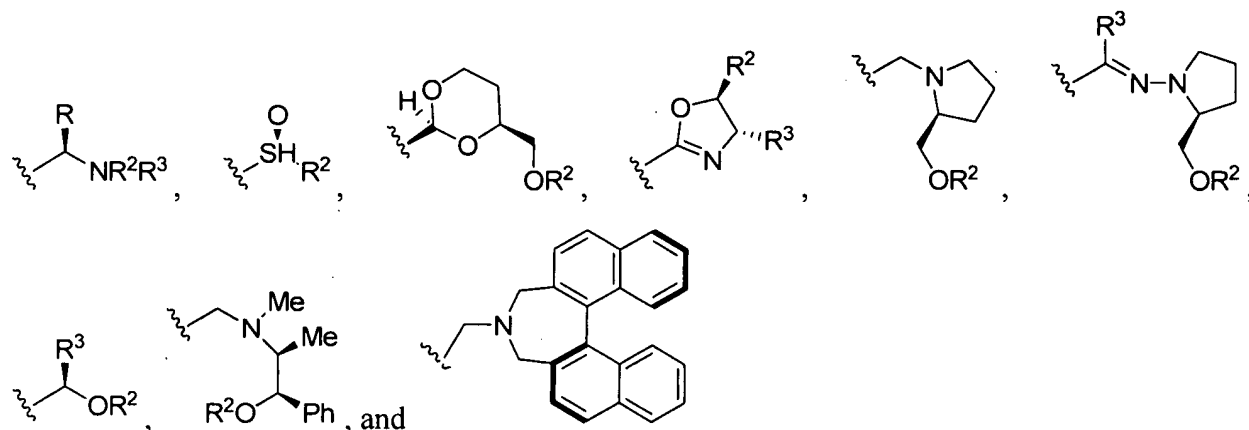
ortho-lithiating the substrate;

converting the ortho-lithiated substrate to a chiral ligand comprising a phosphine group having the formula -PR¹ R^{1''}, wherein R¹ and R^{1''} are different from each other and are independently selected from the group consisting of substituted branched-chain alkyl, substituted straight-chain alkyl, substituted alkoxy, substituted alkylamino, substituted cycloalkyl, substituted cycloalkoxy, substituted cycloalkylamino, substituted carbocyclic aryl, substituted carbocyclic aryloxy, substituted heteroaryl, substituted heteroaryloxy, substituted carbocyclic arylamino, and substituted heteroarylamino, unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted alkoxy, unsubstituted alkylamino, unsubstituted cycloalkyl, unsubstituted cycloalkoxy, unsubstituted cycloalkylamino, unsubstituted carbocyclic aryl, unsubstituted carbocyclic aryloxy, unsubstituted heteroaryl, unsubstituted heteroaryloxy, unsubstituted carbocyclic arylamino, and unsubstituted heteroarylamino.

27. (New) The process according to Claim 26, wherein X* is a chiral directing group and the step of ortho-lithiating is enantioselective.

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28. (New) A process according to Claim 27, wherein X* is selected from the group consisting of



wherein R, R², and R³ are independently selected from the group consisting of unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted cycloalkyl, unsubstituted carbocyclic aryl, unsubstituted heteroaryl, substituted branched-chain alkyl, substituted straight-chain alkyl, substituted cycloalkyl, substituted carbocyclic aryl, and substituted heteroaryl.

29. (New) The process according to Claim 26, wherein X* is an achiral directing group and wherein ortho-lithiating is conducted in the presence of a chiral auxiliary and is enantioselective.

30. (New) The process according to Claim 29, wherein X* is selected from the group consisting of $\text{---NR}^2\text{R}^3$, $\text{---SO}_2\text{R}^2$, $\text{---C(=O)NR}^2\text{R}^3$, and $\text{---P(O)R}^2\text{R}^3$, and wherein R² and R³ are independently selected from the group consisting of unsubstituted branched-chain alkyl, unsubstituted straight-chain alkyl, unsubstituted cycloalkyl, unsubstituted carbocyclic aryl, unsubstituted heteroaryl, substituted branched-chain alkyl, substituted straight-chain alkyl, substituted cycloalkyl, substituted carbocyclic aryl, and substituted heteroaryl.

31. (New) The process according to Claim 26, wherein  is a substituted or unsubstituted aromatic ring of a metallocene compound.

32. (New) The process according to Claim 26, wherein X* is an ortho directing group.

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33. (New) The process according to Claim 26, further comprising the step of reacting the ortho-lithiated substrate with an R¹ substituted phosphine or an R¹ substituted arsine to form an intermediate compound.

34. (New) The process according to Claim 33, comprising reacting the intermediate compound with an R^{1"}-bearing Grignard reagent or organolithium compound.

35. (New) A chiral ligand produced by the process according to Claim 26.

37. (New) A transition metal complex catalyst comprising at least one chiral ligand produced according to the process of Claim 26.

38. (New) An asymmetric catalyst comprising the transition metal complex catalyst of Claim 37.